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Esophagectomy Trends and Postoperative Outcomes at Private Equity–Acquired Health Centers

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IMPORTANCE Growing trends in private equity acquisition of acute care hospitals in the US have motivated investigations into quality of care delivered at these health centers. While some studies have explored comparative outcomes for high-acuity medical conditions, care trends and outcomes of complex surgical procedures, such as esophagectomy, at private equity–acquired hospitals is unknown.

OBJECTIVE To compare structural characteristics and postoperative outcomes following esophagectomy between private equity–acquired and nonacquired health centers.

DESIGN, SETTING, AND PARTICIPANTS This retrospective cohort study included Medicare beneficiaries aged 65 to 99 years who underwent elective esophagectomy at US health centers between January 1, 2016, and December 31, 2020. Health centers were designated as private equity acquired using the Agency for Healthcare Research and Quality Compendium of US Health Systems. Data were analyzed between October 15, 2023, and March 30, 2024.

EXPOSURE Patient cohorts were created based on whether they received care at private equity–acquired or nonacquired health centers.

MAIN OUTCOMES AND MEASURES The main outcome was 30-day postoperative complications, mortality, failure to rescue, and readmission using summary statistics and multivariable logistic regression.

RESULTS A total of 9462 patients (mean [SD] age, 72.9 [5.6] years; 6970 male [73.7%]) underwent esophagectomy during the study period, with 517 (5.5%) receiving care at private equity–acquired institutions. Annual procedure volume was lower at private equity–acquired hospitals vs nonacquired hospitals (median, 2 [IQR, 1-4] vs 7 [IQR, 3-15] procedures per year). Compared with patients treated at nonacquired hospitals, patients treated at private equity–acquired hospitals had significantly higher 30-day mortality (8.1% [95% CI, 5.8%-10.3%] vs 4.9% [95% CI, 4.5%-5.3%]; odds ratio [OR], 1.82 [95% CI, 1.25-2.64]; *P* = .002), any complications (36.6% [95% CI, 32.9%-40.3%] vs 30.1% [95% CI, 29.2%-30.9%]; OR, 1.46 [95% CI, 1.18-1.80]), serious complications (17.5% [95% CI, 14.5%-20.6%] vs 14.3% [95% CI, 13.7%-15.0%]; OR, 1.34 [95% CI, 1.03-1.77]; *P* = .03), and failure to rescue (5.9% [95% CI, 3.9%-7.9%] vs 3.4% [95% CI, 3.1%-3.8%]; OR, 1.86 [95% CI, 1.22-2.84]; *P* = .004).

CONCLUSIONS AND RELEVANCE These findings suggest that patients who undergo esophagectomy at private equity–acquired hospitals may be at risk for worse outcomes. Further understanding of the drivers of these outcomes is needed to improve performance and inform policy pertaining to care allocation for select surgical conditions.

Invited Commentary

Supplemental content

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Private equity acquisition of health systems that contain acute care hospitals is increasing in the US.[1,2] Traditionally, private equity entities acquire outpatient practices or long-term care facilities,[3,4] but progression to health systems has gained attention from the medical community with regard to changes in cost and quality of care.[5,6] The impetus of private equity acquisition of a health care institution is to directly manage and modify care delivery operations with a central goal of maximizing profit and limiting costly inefficiencies.[7] As private equity acquisition of health systems has become more prevalent, both professional physician societies and governmental agencies have called for further investigation of the association of these practices with care quality.[8]

While some investigators have examined care outcomes of inpatient medical conditions at private equity–acquired health centers,[9,10] comparative outcomes for surgical care between nonacquired and private equity–acquired health centers are unknown. As the resources necessary to deliver appropriate surgical care to patients, including infrastructure and trained personnel, are vast and diverse, this particular area of care delivery may be vulnerable in the private equity management model. Furthermore, patients undergoing high-complexity surgical procedures and conditions have been found to have improved outcomes at high-volume specialty centers.[11,12] Thus, there is a need to study the association of private equity acquisition with the quality of complex surgical care being delivered. Esophagectomy is a highly morbid operation that requires substantial structural resources and experienced personnel to maximize postoperative outcomes, making it an exemplary case for high-complexity surgical care.

In this context, the objectives of our study were as follows: (1) to describe health center characteristics of private equity–acquired hospitals compared with nonacquired hospitals and (2) to evaluate the association of postoperative outcomes with status of health center private equity acquisition for patients undergoing esophagectomy. We hypothesized that private equity–acquired hospitals have distinct structural differences compared with nonacquired hospitals and that undergoing esophagectomy at private equity–acquired health centers is associated with worse postoperative outcomes compared with nonacquired centers.

Key Points

Question How do postoperative outcomes following esophagectomy at private equity–acquired health centers compare with outcomes at nonacquired centers?

Findings In this cohort study of 9462 patients who underwent esophagectomy (517 at private equity–acquired hospitals vs 8945 at nonacquired hospitals), those treated at private equity–acquired hospitals had significantly higher rates of 30-day mortality (8.1% vs 4.9%), any complications (36.6% vs 30.1%), serious complications (17.5% vs 14.3%), and failure to rescue (5.9% vs 3.4%).

Meaning These findings suggest that structural characteristics of private equity–acquired health centers may contribute to poorer surgical outcomes in patients undergoing esophagectomy, motivating quality improvement efforts or care allocation for these patients.

Methods

Data Source and Designating Health Centers

This retrospective cohort study used the Medicare Provider Analysis and Review file to identify Medicare beneficiaries aged 65 to 99 years who underwent elective esophagectomy between January 1, 2016, and December 31, 2020. The University of Michigan's institutional review board deemed this study exempt from review and informed consent as it was a retrospective analysis using publicly available, deidentified data. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.

We used the Agency for Healthcare Research and Quality (AHRQ) Compendium of US Health Systems to identify whether a health center had been acquired by a private equity entity. The compendium is a curated list of health systems with the central goal of providing a resource to study how health systems promote evidence-based practices in health care delivery.[13] The AHRQ defines a health system as an entity with common ownership that contains at least 1 acute care hospital and at least 1 physician group to provide comprehensive primary and specialty care.[13] We defined a health center as acquired by private equity if it is part of a health system and that system is designated as major investment owned in the compendium version most closely corresponding to the year of the procedure in a given observation. The AHRQ compendium has been used in several other studies to evaluate cohorts of Medicare beneficiaries.[14,15]

We also used the American Hospital Association Annual Survey to identify details about each hospital in our study.[16] Each hospital was then linked to the AHRQ compendium using its unique Centers for Medicare & Medicaid Services Certification Number. Information about hospital bed size, for-profit status, and nurse to patient ratios were obtained from this data source.

Cohort Selection

Patients undergoing esophagectomy were identified using *International Statistical Classification of Diseases, Tenth Revision* (*ICD-10*) procedure codes. The *ICD-10* codes were identified for excision or resection of the partial or total esophagus via any operative approach. Selected *ICD-10* codes are included in eTable 1 in Supplement 1.

Outcomes of Interest

Postoperative outcomes of interest between private equity–acquired and nonacquired health centers included mortality rate at 30 days, occurrence of any complication, occurrence of serious complication, failure to rescue, and rate of readmission at 30 days. To identify 30-day mortality, 2 approaches were used. First, the Medicare Beneficiary Denominator File was used to identify any mortality event that occurred within 30 days of the index operation but after discharge from the hospital. Second, mortality events that occurred during the index admission were determined by vital signs at the time of discharge. Postoperative complications were determined using

ICD-10 codes previously validated by the Complication Screening Project to be specific for surgical patient cohorts.[17,18] These complications and their associated *ICD-10* codes are provided in eTable 2 in Supplement 1. Serious complication occurrence was defined as having at least 1 postoperative complication and a postoperative length of stay greater than the 75th percentile for the given index operation, which has been described previously.[19,20] Failure to rescue is a well-defined outcome determined as a death occurring in a patient with at least 1 documented postoperative complication (eTable 2 in Supplement 1) during the postoperative period.[21-23] Readmission was defined as an inpatient admission occurring within 30 days of discharge from the original postoperative admission.[24] These approaches to outcomes identification are well supported in other studies investigating thoracic surgical procedures using Medicare claims data.[25,26]

Statistical Analysis

The data for this study were analyzed between October 15, 2023, and March 30, 2024. First, patient demographics, including age, sex, and race and ethnicity based on the Medicare Provider Analysis and Review file (Asian, Black, Hispanic, Native American, White, other, unknown) and clinical characteristics, including Elixhauser comorbidities and oncologic resection, were described using summary statistics between patients treated at private equity–acquired and nonacquired centers. Race and ethnicity were included to provide context of the patient populations receiving care at private equity–acquired health centers. Second, health center characteristics, including center case volume, nurse to patient ratio, teaching status, and geographic concentration, were compared using similar descriptive statistics.

To evaluate differential postoperative outcomes between private equity–acquired hospitals and nonacquired hospitals for patients undergoing esophagectomy, we created a multivariable logistic regression model for each outcome of interest, with hospital private equity status as the independent variable and patient age, sex, Elixhauser comorbidities,[27] procedure type (grouped as resection of the upper, middle, or lower esophagus), procedure approach (open or minimally invasive), and year of procedure as covariates. Any patient observations for which data were missing for variables included for characterization and analysis were dropped from the analysis. A sensitivity analysis was performed to adjust for volume-outcome effects by repeating the analysis only with a cohort of patients undergoing esophagectomy at health centers that were in the lowest quartile of annual hospital esophagectomy volume, as most private equity–acquired centers were in the lowest volume quartile. All analyses were performed using Stata, version 18.0 (StataCorp LLC), with a 2-sided significance threshold of 5% for all hypothesis testing.

Results

Patient Characteristics

During the study period, a total of 9462 patients underwent elective esophagectomy (mean [SD] age, 72.9 [5.6] years; 2492 female [26.3%] and 6970 male [73.7%]; 91 Asian [1.0%], 402 Black [4.2%], 86 Hispanic [0.9%], 22 Native American [0.2%], 8475 White [89.6%], 132 other [1.4%], and 254 unknown [2.7%] race and ethnicity), with 517 (5.5%) receiving care at private equity–acquired health centers. Patients undergoing esophagectomy at private equity–acquired hospitals were slightly older (mean [SD] age, 74.0 [6.2] vs 72.9 [5.6] years; $P < .001$) and tended to have fewer comorbidities (**Table 1**). There was no significant difference in sex or race distribution among patients undergoing esophagectomy at private equity–acquired hospitals vs those undergoing esophagectomy at nonacquired hospitals.

Health Center Characteristics

A total of 954 distinct health centers performed esophagectomy during the study period, of which 132 (13.9%) were private equity–acquired and 822 (86.1%) were nonacquired. Over the study period, the number of hospitals performing esophagectomy declined (**Figure 1**). Compared with nonacquired centers, private equity–acquired centers had a lower annual esophagectomy case volume (median, 2 [IQR, 1-4] vs 7 [IQR, 3-15] procedures per year; $P < .001$), had a lower nurse to patient ratio (mean [SD], 7.9 [3.6] vs 9.6 [3.3]; $P < .001$), were less likely to be a teaching institution (5 [3.8%] vs 203 [24.5%]; $P < .001$), and were more geographically concentrated in the South (80 [60.2%] vs 271 [32.8%]) and West (37 [27.8%] vs 186 [22.5%]; $P < .001$) (**Table 2**).

Postoperative Outcomes

After risk adjustment, all assessed postoperative outcomes following esophagectomy, except for readmission, within 30 days were worse for patients undergoing esophagectomy at private equity–acquired health centers (**Table 3**; **Figure 2**). Compared with patients at nonacquired centers, patients who underwent esophagectomy at private equity–acquired health centers had a significantly higher 30-day mortality rate (8.1% [95% CI, 5.8%-10.3%] vs 4.9% [95% CI, 4.5%-5.3%]; odds ratio [OR], 1.82 [95% CI, 1.25-2.64]; $P = .002$). Additionally, these patients had higher rates of any complication (36.6% [95% CI, 32.9%-40.3%] vs 30.1% [95% CI, 29.2%-30.9%]; OR, 1.46 [95% CI, 1.18-1.80]; $P = .001$), serious complication (17.5% [95% CI, 14.5%-20.6%] vs 14.3% [95% CI, 13.7%-15.0%]; OR, 1.35 [95% CI, 1.03-1.77]; $P = .03$), and failure to rescue (5.9% [95% CI, 3.9%-7.9%] vs 3.4% [95% CI, 3.1%-3.8%]; OR, 1.86 [95% CI, 1.22-2.84]; $P = .004$). No significant difference in readmission rates was found between patients at private equity–acquired centers vs those at nonacquired centers (21.2% [95% CI, 17.6%-24.7%] vs 19.2% [95% CI, 18.4%-20.0%]; OR, 1.13 [95% CI, 0.91-1.41]; $P = .28$).

Sensitivity Analysis

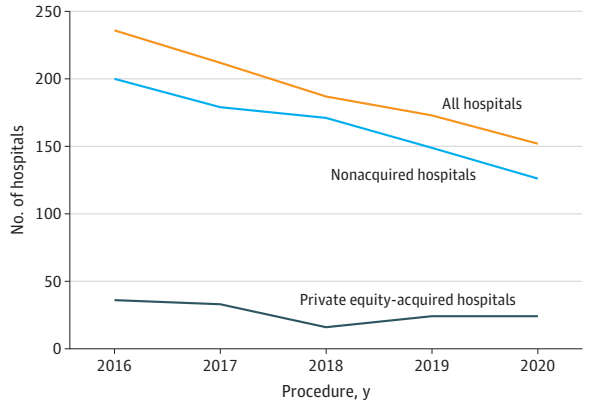
A sensitivity analysis that included only patients undergoing esophagectomy at hospitals in the lowest quartile of annual volume was performed. The cohort included 2878 patients, with 337 (11.7%) having undergone resection at private equity–acquired institutions. The 30-day mortality and any complication rates remained significantly higher at private equity–acquired vs nonacquired institutions. Com-

Table 1. Demographic and Clinical Characteristics for Medicare Beneficiaries Undergoing Esophagectomy at Private Equity–Acquired Hospitals and Nonacquired Hospitals, 2016-2020

Characteristic	No. (%)			*P* value
	Total (n = 9462)	Nonacquired hospitals (n = 8945)	Private equity–acquired hospitals (n = 517)	
Age, mean (SD), y	72.9 (5.6)	72.9 (5.6)	74.0 (6.2)	<.001
Sex				
Female	2492 (26.3)	2358 (26.4)	134 (25.9)	.82
Male	6970 (73.7)	6587 (73.6)	383 (74.1)	
Race and ethnicity[a]				
Asian	91 (1.0)	89 (1.0)	2 (0.4)	.19
Black	402 (4.2)	376 (4.2)	26 (5.0)	
Hispanic	86 (0.9)	80 (0.9)	6 (1.2)	
Native American	22 (0.2)	21 (0.2)	1 (0.2)	
White	8475 (89.6)	8004 (89.5)	471 (91.1)	
Other	132 (1.4)	127 (1.4)	5 (1.0)	
Unknown	254 (2.7)	248 (2.8)	6 (1.2)	
No. of Elixhauser comorbidities				
0	562 (5.9)	518 (5.8)	44 (8.5)	.04
1	1382 (14.6)	1309 (14.6)	73 (14.1)	
≥2	7518 (79.5)	7118 (79.6)	400 (77.4)	
Oncologic resection				
Yes	6557 (69.3)	6247 (69.8)	310 (60.0)	<.001
No	2905 (30.7)	2698 (30.2)	207 (40.0)	

[a] Race and ethnicity categories are per the Centers for Medicare & Medicaid Services Beneficiary Summary File. The file does not provide further granularity for races and ethnicities included in the Other distinction.

Figure 1. Temporal Trends of Number of Hospitals Performing Esophagectomy, 2016-2020



pared with patients undergoing esophagectomy at nonacquired centers, those treated at private equity–acquired centers had a higher 30-day mortality (8.4% [95% CI, 5.6%-11.2%] vs 5.6% [95% CI, 4.7%-6.4%]; OR, 1.67 [95% CI, 1.04-2.66]; *P* = .003) and a higher rate of any complication (37.7% [95% CI, 33.1%-42.2%] vs 32.5% [95% CI, 31.0%-34.1%]; OR, 1.35 [95% CI, 1.02-1.78]; *P* = .03) (eTable 3 in Supplement 1). While statistical significance was not found for rates of serious complications, failure to rescue, or readmission between the sensitivity analysis groups, all adjusted outcome categories favored patients undergoing esophagectomy at nonacquired hospitals (eFigure in Supplement 1).

Discussion

In this cohort study investigating center characteristics and comparative outcomes for patients undergoing esophagectomy, there were 2 principal findings. First, volume and structural differences exist between private equity–acquired health centers and nonacquired centers delivering esophagectomy care. Second, patients undergoing esophagectomy at private equity–acquired centers have significantly higher rates of mortality, complications, and failure to rescue. Together, these findings suggest that poorer postoperative outcomes at private equity–acquired health centers may be attributed to characteristic structural differences associated with private equity acquisition.

Esophagectomy is a high-complexity operation that requires substantial structural resources and practitioner expertise. Complication rates are high, with national estimates of up to 64% of patients having some kind of postoperative complication.[28] Mortality following esophagectomy is variable; however, contemporary reports range from 2% to 8%.[29,30] Consequently, there have been prior investigations of institution-level factors that portend improved outcome trends, namely the association of esophagectomy volume with postoperative outcomes. For example, Holleran et al[31] showed a direct association between institutional esophagectomy volume and improved postoperative mortality and length of stay, although other studies had conclusions that contrasted this claim.[26] Additionally, Dolan et al[32] found a positive association between surgeon volume and favorable postoperative outcomes following esophagectomy at the same institution, sup-

Table 2. Hospital Characteristics for Private Equity–Acquired vs Nonacquired Health Centers

Characteristic	No. (%)			*P* value
	Total (N = 954)	Nonacquired hospitals (n = 822)	Private equity–acquired hospitals (n = 132)	
Annual hospital volume, median (IQR), cases	6 (3-14)	7 (3-15)	2 (1-4)	<.001
Hospital geographic region				
Midwest	225 (23.4)	216 (26.1)	9 (6.8)	<.001
Northeast	155 (16.1)	149 (18.0)	6 (4.5)	
South	351 (36.6)	271 (32.8)	80 (60.2)	
West	223 (23.2)	186 (22.5)	37 (27.8)	
Teaching hospital				
No	746 (77.7)	619 (74.8)	127 (95.5)	<.001
Yes	208 (21.7)	203 (24.5)	5 (3.8)	
Urban hospital				
No	106 (11.0)	96 (11.6)	10 (7.5)	.37
Yes	848 (88.3)	726 (87.8)	122 (91.7)	
Nurse to patient ratio, mean (SD)	9.3 (3.4)	9.6 (3.3)	7.9 (3.6)	<.001

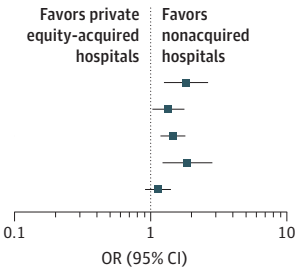
Table 3. Comparative Risk-Adjusted Postoperative Outcomes Following Esophagectomy at Private Equity–Acquired vs Nonacquired Hospitals

Postoperative outcome	Risk-adjusted rates, % (95% CI)		OR (95% CI)	*P* value
	Nonacquired hospitals	Private equity–acquired hospitals		
30-d Mortality	4.9 (4.5-5.3)	8.1 (5.8-10.3)	1.82 (1.25-2.64)	.002
Serious complication	14.3 (13.7-15.0)	17.5 (14.5-20.6)	1.35 (1.03-1.77)	.03
Any complication	30.1 (29.2-30.9)	36.6 (32.9-40.3)	1.46 (1.18-1.80)	.001
Failure to rescue	3.4 (3.1-3.8)	5.9 (3.9-7.9)	1.86 (1.22-2.84)	.004
Readmission	19.2 (18.4-20.0)	21.2 (17.6-24.7)	1.13 (0.91-1.41)	.28

Abbreviation: OR, odds ratio.

Figure 2. Risk-Adjusted Odds Ratios (ORs) for Complications Following Esophagectomy at Private Equity–Acquired vs Nonacquired Hospitals

Postoperative outcome	OR (95% CI)
30-d Mortality	1.82 (1.25-2.64)
Serious complication	1.35 (1.03-1.77)
Any complication	1.46 (1.18-1.80)
Failure to rescue	1.86 (1.22-2.84)
Readmission	1.13 (0.91-1.41)



porting the volume-outcome relationship. These studies support the theoretical benefit of undergoing esophagectomy at a high-volume institution with appropriate staff expertise and available structural resources for patient care. Our work shows that private equity–acquired institutions have both lower volumes and worse outcomes, which may support this trend.

Our sensitivity analysis, which analyzed comparative outcomes for similarly low-volume nonacquired and private equity–acquired health centers, showed a persistence in worse 30-day mortality and any complication rates for patients undergoing esophagectomy at private equity–acquired centers. This finding suggests that there are additional contributing institutional factors at play at private equity–acquired health centers than simply a volume-outcome association for esophagectomy care. It is possible that additional structural elements of an institution may play a role in postoperative outcomes for high-complexity surgery, for which esophagectomy is exemplary. These elements may include, but are not limited to, intensive care unit organization and multidisciplinary care teams, which have been shown to be associated with lower rates of adverse outcomes.[33]

Failure to rescue has gained much attention in surgical outcomes research over the past 2 decades, particularly for high-complexity operations. This is founded in the theoretical framework that it is not the incidence of complications that affects postoperative mortality but rather delays or omissions of timely recognition and subsequent treatment of complications before further adverse outcomes are compounded. Failure to rescue has been well studied in esophagectomy.[34-36] Age, race and ethnicity, and American Society of Anesthesiologists class are known to be patient-level factors associated with failure to rescue.[37] Abdelsattar et al[38] showed that center volume for esophagectomy was directly associated with rescue, suggesting that this may be the mechanism of the volume-outcome association. The results of this study both confirm this association and show an association between hospital acquisition status and failure to rescue. This concept, coupled with known and confirmed volume as-

sociations, highlights the need for care allocation patterns for patients requiring esophagectomy.[39]

Additional structural elements found to differ between private equity-acquired and nonacquired centers included nurse to patient ratio and teaching hospital status. Nurse to patient ratio is well known to be associated with postoperative complications and rescue, as confirmed by Sheetz et al,[40] who specifically identified increased failure to rescue in patients undergoing esophagectomy at hospitals with lower nurse to patient ratios. Others have investigated comparative outcomes for patients undergoing esophagectomy at teaching vs nonteaching hospitals.[41] For example, Dikken et al[42] showed worse mortality rates following esophagectomy at nonteaching hospitals. Thus, since both of these factors were found to be lower in our study at private equity-acquired health centers, it is possible that they play a role in worse postoperative outcomes in these patients.

These findings have important implications for high-complexity surgical care delivered at health centers acquired by private equity entities. First, characteristic structural differences exist for private equity-acquired centers that are associated with lower-quality surgical care for high-complexity operations, including institutional volume, nurse to patient ratio, and teaching hospital status. These examples of a multitude of systemic changes may be influenced by private equity acquisition. Second, worse postoperative outcomes for patients undergoing esophagectomy at private equity-acquired institutions call into question the appropriateness of whether these institutions should provide high-complexity surgical care.

Limitations

Our study should be considered in the context of several limitations. First, there is a lack of clinical granularity inherent to the use of claims data for Medicare beneficiaries, making ascertainment of comorbidities; oncologic details such as staging, resection margin status, or multimodality therapy use; and complications challenging.[43,44] This potential bias was mitigated by using selected codes from the Complication Screening Project specifically for identifying postoperative complications, a practice described previously.[17,18] Second, because the cohort comprised Medicare beneficiaries, our study is confined to patients older than 65 years, limiting generalizability to younger patients. However, a large proportion of patients undergoing esophagectomy fall into this age category, and the Medicare population provides the advantage of a nationally representative patient cohort. Third, while the AHRQ compendium is a well-vetted source of health systems data, time point data of acquisition is not recorded; thus, we were unable to examine temporality with regard to private equity acquisition of health centers. Ongoing work is therefore needed to assess temporal associations of private equity acquisition with center-level structural characteristics. Finally, while our data sources facilitate comparison of some center-level characteristics that may influence patient outcomes, this analysis does not provide an exhaustive comparison of institutional characteristics involved in patient care. Additional factors, such as physician board certification or specialist training, may also differ at private equity-acquired centers and may be associated with patient outcomes, thus motivating future investigations of these elements.

Conclusions

The results of this cohort study suggest that one possible solution for mitigating risks associated with patients undergoing esophagectomy at private equity-acquired hospitals is to address structural and systemic factors. One example of an institution-level improvement strategy may be the adoption and implementation of esophagectomy-specific enhanced recovery after surgery protocols, which have been well established at other centers and shown to both improve postoperative outcomes and lower health care costs associated with esophagectomy.[45,46] Alternatively, allocation of esophagectomy care to nonacquired, high-volume, experienced centers may also mitigate this risk if structural improvement in private equity-acquired centers is not possible. Consideration of center-level structural changes associated with private equity acquisition may inform policy changes or center accreditations for complex surgical care. As private equity acquisition of health centers and practices has an uneven geographic distribution in the US,[47] it is possible that policy considerations may be best made at the state level to reflect a given area's penetrance of acquisition and should be done in parallel with careful consideration of access to high-quality care for vulnerable patient populations.[48] Our findings suggest that center-level factors outside of case volume alone may influence outcomes for patients undergoing high-complexity operations, which may better inform center designations by advocacy groups who have historically been focused on case volume alone.[49] Further investigations into structural drivers of outcome differences at private equity-acquired health centers are necessary to inform potential regulations for esophagectomy care and other similar high-complexity surgical conditions.

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Acquisition, analysis, or interpretation of data: All authors.
Drafting of the manuscript: Williams, Odell.
Critical review of the manuscript for important intellectual content: All authors.
Statistical analysis: Williams, Schaefer, Odell.
Obtained funding: Odell.
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Supervision: Ibrahim, Odell.

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